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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Paper No. 20040603

Application Number: 09/943,355
Filing Date: August 31, 2001
Appellant(s): ARAKAWA, SATOSHI

Stan Torgovitsky
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed April 27, 2004.

(0) Citations of Statute

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action (final action of October 29, 2003).

(1) Real Party in Interest

A statement identifying the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) Status of Claims

The statement of the status of the claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Invention

The summary of invention contained in the brief is correct.

(6) Issues

The appellant's statement of the issues in the brief is correct.

(7) Grouping of Claims

Appellant's brief includes a statement that claims 7 and 15 do not stand or fall together and provides reasons as set forth in 37 CFR 1.192(c)(7) and (c)(8).

(8) Claims Appealed

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) Prior Art of Record

US 5,115,132 A	SAOTOME ET AL.	5-1992
JP 11-38533 A	ARAKAWA	2-1999
US 4,814,616 A	SAOTOME	3-1989

(10) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1-5, 7, 17, 19, 9-13, 15, 18, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Saotome *et al.* (US005115132A) in view of Arakawa (JP11-38533A).

In view of the statement under 37 CFR 1.192(c)(7), the explanation of rejection is applied against independent claim 9 and dependent claim 15/9.

With respect to independent claim 9, Saotome *et al.* discloses a radiation image recording and read-out apparatus **200** (Fig. **10**) comprising (i) an image recording section **280** of the recited type for supporting a stimulable phosphor sheet **226**, (ii) image read-out means **250** of the recited type with stimulating rays **252** and emitted light **40** photoelectrically detected at **254**, and (iii) erasing light sources **261** located in close vicinity to the stimulable phosphor sheet **226**, but the erasing light sources are not (illustrated as) sheet-shaped or on the side of the sheet **226** exposed to radiation. The stimulable phosphor sheet **226** in the apparatus of Saotome *et al.* comprises a sheet-shaped transparent substrate and a stimulable phosphor layer (column 15, lines 34-38) exactly as recited. Furthermore, the stimulating rays **252** for the image read-out irradiate the stimulable phosphor layer at the side opposite to the side exposed to the radiation (in Fig. **10**, the stimulable phosphor sheet **226** is exposed to radiation for the image recording from above, while the stimulating rays **252** irradiate the stimulable phosphor sheet **226** for image read-out from below) exactly as required. A sheet-shaped erasing light source is recognized by Saotome *et al.* as equivalent to the fluorescent

lamps **261** illustrated in Fig. **10**. See especially column 10, line 64 to column 11, line 5 where the equivalence of a sheet-shaped erasing light source ("plate" at column 11, line 3) to fluorescent lamps (column 10, lines 67-68) is made explicit. Arakawa shows that a sheet-shaped erasing light source **30** located in close vicinity to the stimulable phosphor sheet **20** and on a side of the one surface of the sheet supported at the position for image recording (of object **50**) which is exposed to the radiation and furthermore irradiating erasing light to an entire area of the sheet **20** is known. Because the source **30** in the apparatus of Arakawa is between the source **11** and the sheet **20**, its uniform transmissivity to radiation may be presumed. The sheet-shaped erasing light source **30** of Arakawa is plainly more compact than the bulky sources **261** of Saotome, and uses the exact technology identified by Saotome *et al.* as equivalent thereto, so it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Saotome to comprise a sheet-shaped source erasing light in the location suggested by Arakawa since a smaller case **229** could be achieved that way.

With respect to dependent claim 15/9, Saotome *et al.* discloses a radiation image recording and read-out apparatus **100** (Fig. **9A**) comprising (i) an image recording section **101** of the recited type for supporting a stimulable phosphor sheet **102** and keeping it stationary at this position, (ii) image read-out means **120** as a read-out unit **104** of the recited type with stimulating rays **121A** and emitted light **40** photoelectrically detected at **27** and unit moving means **140**, and (iii) an erasing light source **131** located in close vicinity to the stimulable phosphor sheet **102**, but the erasing light source is not (illustrated as) sheet-shaped, nor is it on the side of the sheet **102** exposed to radiation. Nevertheless, the stimulable phosphor sheet **102** in the apparatus of Saotome *et al.* comprises a sheet-shaped transparent substrate **102A** and a stimulable phosphor layer **102B** (column 13, lines 16-19) exactly as recited. Furthermore, the stimulating rays **121A** for the image read-out irradiate the

stimulable phosphor layer at the side opposite to the side exposed to the radiation (in Fig. **9A**, the stimulable phosphor sheet **102** is exposed to radiation for the image recording from above, while the stimulating rays **121A** irradiate the stimulable phosphor sheet **102** for image read-out from below) exactly as required. A sheet-shaped erasing light source is recognized by Saotome *et al.* as equivalent to the fluorescent lamp **131** illustrated in Fig. **9A**. See especially column 10, line 64 to column 11, line 5 where the equivalence of a sheet-shaped erasing light source ("plate" at column 11, line 3) to fluorescent lamps (column 10, lines 67-68) is made explicit. Arakawa shows that a sheet-shaped erasing light source **30** located in close vicinity to the stimulable phosphor sheet **20** and on a side of the one surface of the sheet supported at the position for image recording (of object **50**) which is exposed to the radiation and furthermore irradiating erasing light to an entire area of the sheet **20** is known. Because the source **30** in the apparatus of Arakawa is between the source **11** and the sheet **20**, its uniform transmissivity to radiation may be presumed. The sheet-shaped erasing light source **30** of Arakawa is plainly more compact than the bulky source **131** of Saotome, and in view of the reduced overhang past the edge of the stimulable phosphor sheet (column 13, lines 14-16) required if unit **104** omitted the erasing light source **131** and in view of the compatibility of housing **111** with the sheet-shaped erasing light source **30** suggested by Arakawa, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Saotome to comprise a sheet-shaped source erasing light in the location suggested by Arakawa since a smaller case **111** could be achieved that way.

Claims 6 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Saotome *et al.* and Arakawa as applied to claims 3, 4, or 5, or 11, 12, or 13, and further in view of Saotome (US004814616A).

In view of the statement under 37 CFR 1.192(c)(7), and the absence of argument (see page 10 of the brief) these claims may be considered to stand or fall together with their respective base claims, dependent claims 3-5 and 11-13, which are in turn considered to stand or fall together with their respective base claims, independent claims 1 and 9.

Claims 8 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Saotome *et al.* and Arakawa as applied to claims 7 and 15, and further in view of Ohyama *et al.* (US004767927A).

In view of the statement under 37 CFR 1.192(c)(7), and the absence of argument (see page 10 of the brief) these claims may be considered to stand or fall together with their respective base claims, dependent claims 7 and 15.

(11) Response to Argument

In response to appellant's argument that the EL panel **30** of Arakawa is "incapable" of achieving the strong erasing already disclosed by the sources **131** and **261** of Saotome *et al.*, see page 7 of the brief, leaving aside that appellant has asserted a comprehensive evaluation of the sufficiency of the erasing light source **30** of Arakawa for strong erasing on the basis of its use for *50 milliseconds* (paragraph [0034]) in that disclosure, consider that the adequacy of an EL (electroluminescence) plate (that is, the type of erasing light source taught at **30** by Arakawa) as an erasing light source for strong erasing is explicitly established as a known alternative to lamps of various types (including the fluorescent lamps used at **131** and **261** in the apparatus of Saotome *et al.*) at column 10, line 64 to column 11, line 5, column 19, lines 44-49, and column 23, lines 4-9 of Saotome *et al.*, the primary reference applied in the rejection. The equivalency of a sheet-shaped erasing light source to the erasing light source **131** or the erasing light sources **261** is, accordingly, recognized in the prior art and an express suggestion to substitute one equivalent component for another is not necessary to render such substitution obvious. MPEP § 2144.06. The proposition that a sheet-shaped erasing

light source, of the exact kind disclosed by Arakawa, cannot play a role in releasing the entire energy from a stimulable phosphor sheet, as required by Saotome *et al.*, is exposed as based on an inadequate reading of the references and cannot be persuasive.

Arakawa is useful to suggest the particular placement and size of an erasing light source. But appellant has no argument against the proposed combination of Saotome *et al.* and Arakawa, as applied to independent claim 9, other than the alleged inadequacy of an electroluminescent panel as an erasing light source, see pages 6 and 7 of the brief.

In response to appellant's argument that the references fail to show certain features of appellant's invention, it is noted that the features upon which appellant relies (*i.e.*, simple and compact structure achieved by advantageous implementations of the embodiments, see page 8 of the brief) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. The stationary stimulable phosphor sheet **102** and moving image read-out unit **104** are incontrovertibly disclosed in Fig. **9A** of Saotome *et al.* as explained in the rejection of claim 15/9. The sheet-shaped erasing light source is known by Saotome *et al.* and its placement as suggested by Arakawa reasonably accords with the case **111** of Saotome *et al.* Accordingly, all of the recited elements of claim 15/9 are disclosed and/or suggested by the applied references and appellant's argument of the impossibility of bodily incorporation is not a proper legal test of the obviousness of the combination.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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ch
June 3, 2004

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PTO 04-3286 HAMT

Japanese Patent
Document No. 11-038533

METHOD FOR ACQUIRING IMAGE INFORMATION FOR ENERGY SUBTRACTION AND APPARATUS FOR ACQUISITION THEREOF

[エネルギーサブトラクション用画像情報の取得方法および取得装置]

Satoru Arakawa

UNITED STATES PATENT AND TRADEMARK OFFICE
Washington, D.C. 05/2004

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(57) [Abstract]

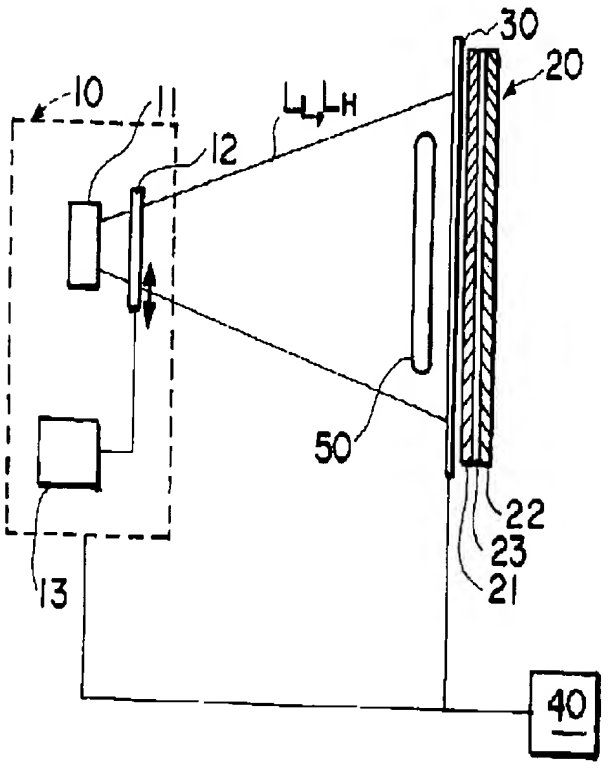
[Problems to be Solved by the Invention]

In acquisition device of image information for energy subtraction processing, while guaranteeing the large energy difference between 2 image data, overlay position precision it improves.

[Means to Solve the Problems]

radiation L_0 which radiation is done, transmitting Cu filter 12 from the radiation electric bulb 11, to make high

pressure radiation L_H, irradiating this high pressure radiation L_H to subject 50 and the high pressure image information S_H to record to accumulation behavior phosphor layer 21, 22, just short time light emitting doing EL panel 30 at once, to eliminate high pressure radiation L_H which is recorded to accumulation behavior phosphor layer 21 of subject 50 side, continuously, after evacuating Cu filter 12, radiation doing radiation L_0 from radiation electric bulb 11, low pressure image information S_L of subject 50 is recorded to accumulation behavior phosphor layer 21 of subject 50 side.



[Claim(s)]

[Claim 1]

Concerning same subject, with acquiring method of image information for energy subtraction which acquires low pressure image information which corresponds to low pressure radiation where the high pressure image information and low energy component which correspond to high pressure radiation where high energy component is emphasized relatively are emphasized relatively respectively,

Irradiating aforementioned high pressure radiation to aforementioned subject, it records high pressure image information which corresponds to aforementioned high pressure radiation which transmitted said subject, to accumulation behavior phosphor sheet for both surfaces light collection which respectively can detect light emitting from both aspects of surface and back surface which face to aforementioned subject,

image information which is recorded to portion of aforementioned front side said accumulation behavior phosphor sheet, mainly is eliminated,

Next, irradiating aforementioned low pressure radiation to aforementioned subject, it records low pressure image information which corresponds to aforementioned low pressure radiation which transmitted said subject, to aforementioned accumulation behavior phosphor sheet,

Aforementioned low pressure image information is acquired, from portion of the aforementioned front side of aforementioned accumulation behavior phosphor sheet, aforementioned high pressure image information is acquired from portion of aforementioned back side acquiring method. of image information for energy subtraction which is made feature

[Claim 2]

As for elimination of image information which is recorded to portion of the aforementioned front side,

Opposing, to aforementioned surface of aforementioned accumulation behavior phosphor sheet, it was provided, extending to entire surface, roughly uniform radiation doing elimination light from elimination light source of flat plate which possesses structure acquiring method. of image information for energy subtraction which is stated in Claim 1 which it does and makes feature

[Claim 3]

You use predetermined radiation as aforementioned low pressure radiation, you use those which were transmitted in high low pressure component absorbing member said predetermined radiation, in comparison with the absorbance for low energy component for high energy component as aforementioned high pressure radiation acquiring method. of image information for energy subtraction which is stated in the Claim 1 or 2 which is made feature

[Claim 4]

Changing high pressure radiation and low pressure radiation, acquiring method. of image information for energy subtraction which is stated in Claim 1 or 2 which from single radiation source of radiation possibility, selectively radiation does aforementioned high pressure radiation or the low pressure radiation and makes feature

[Claim 5]

From lighting of aforementioned high pressure radiation it irradiates the aforementioned low pressure radiation within 100 millisecond, until it makes feature, acquiring method. of image information for energy subtraction which is stated in any one claim inside Claim 1 to 4

[Claim 6]

Concerning same subject, with acquisition device of image information for energy subtraction which acquires low pressure image information which corresponds to low pressure radiation where the high pressure image information and low energy component which correspond to high pressure radiation where high energy component is emphasized relatively are emphasized relatively respectively,

selectively changing aforementioned high pressure radiation and aforementioned low pressure radiation, radiation source which it can do and,

Irradiating aforementioned subject, it can detect light emitting respectively from both aspects of surface and back surface which were allotted to location which receives radiation which transmitted said subject face to aforementioned subject, accumulation behavior phosphor sheet for both surfaces light collection and,

Opposing, to aforementioned surface of said accumulation behavior phosphor sheet, it was provided, extending to entire surface, elimination light source of flat plate which the elimination light which eliminates image information which roughly uniform possesses structure, is recorded to portion of aforementioned front side mainly radiation is done and,

Radiation doing aforementioned high pressure radiation from aforementioned radiation source, recording aforementioned high pressure image information to aforementioned accumulation behavior phosphor sheet, after that radiation doing elimination light from aforementioned elimination light source, , to eliminate image information which is recorded to the portion of aforementioned front side mainly next, radiation doing the aforementioned low

pressure radiation from aforementioned radiation source and recording the aforementioned low pressure image information to aforementioned accumulation behavior phosphor sheet, acquisition device. of image information for energy subtraction where you acquired the aforementioned low pressure image information, from portion of aforementioned front side of aforementioned accumulation behavior phosphor sheet, had control means which forms control which acquires aforementioned high pressure image information from portion of aforementioned back side makes feature

[Claim 7]

low pressure component absorbing member where aforementioned radiation source, radiation are done taking in and out could provide single radiation unrestrictedly between radiation electric bulb and said electric bulb and aforementioned subject which is high in comparison with absorbance for low energy component of aforementioned radiation for high energy component and, Following to predetermined finger display signal, aforementioned low pressure component absorbing member having drive means which it takes in and out drives between aforementioned electric bulb and aforementioned subject, acquisition device. of image information for the energy subtraction which is stated in Claim 6 which becomes and makes feature

[Claim 8]

Aforementioned radiation source, following to predetermined finger display signal, changing high pressure radiation and low pressure radiation, is something which consists of the single radiation electric bulb of radiation possibility and acquisition device. of image information for the energy subtraction which is stated in Claim 6 which is made feature

[Claim 9]

acquisition device. of image information for energy subtraction which is stated in any one claim inside Claims 6 through 8 where with aforementioned control means, time to lighting of aforementioned low pressure radiation is set within 100 millisecond from lighting of aforementioned high pressure radiation and makes feature

[Description of the Invention]

[0001]

[Technological Field of Invention]

this invention regards acquiring method and device of image information for energy subtraction, in detail, image of 1 kind at a time is obtained with photographing twice, it is something regarding acquiring method, device of the image information for so-called 2 shot energy subtraction.

[0002]

[Prior Art]

Grasping radiation image which is recorded, you obtain image signal, after administering appropriate image processing to this image signal, regeneration recording image is done with various field.

In addition when radiation (X-ray, α-ray, β-ray, γ-ray, electron beam, ultraviolet light, etc.) is irradiated with this applicant, when portion of this radiation energy is done, compilation after that irradiates the visible light or other stimulation light making use of accumulation behavior phosphor (bright phosphor) which shows accelerated phosphorescence light emitting according to energy which compilation is done, to accumulation behavior phosphor of sheet to photograph record radiation image of human body or other subject, scan doing this accumulation behavior phosphor sheet with laser light or other stimulation light and doing to cause the accelerated phosphorescence emitted light once, Grasping accelerated phosphorescence emitted light which it acquires in photoelectric, you obtain image data, radiation image recording recycling system which it outputs to the photographic photosensitive material or other recording material, CRT etc as visible image has already been

proposed radiation image of the subject on basis of this image data, (Japan Unexamined Patent Publication Showa 55-12429 number, same 56 - 11395, same 55 - 163472, same 56 - 104645, same 55 - 116340 etc).

[0003]

According to this system, latitude is wide, radiation image where the observation reading shadow suitability is superior can be acquired.

[0004]

In addition as description above grasping radiation image of plural which is recorded in system which uses radiation film and accumulation behavior phosphor sheet etc, after acquiring image data of plural, it administers subtraction processing of above-mentioned radiation image, on basis of these image data is.

[0005]

Here, subtraction processing of radiation image calls processing which obtains image which corresponds to difference of radiation image of the plural which was photographed with condition which differs mutually, image data of digital of plural which grasps radiation image of these plural concretely with predetermined sampling spacing and corresponds to each radiation image obtaining, Is processing which obtains radiation image which it emphasizes or extracts only specific subject portion (Below, it names also tissue or structure or other shadow) in radiation image, or each pair application/response of image data of these plural by administering subtraction processing every sampling point (pixel) which is done.

[0006]

In this subtraction processing there is following two in basic.

radiation image where contrast agent is not filled from radiation image where the specific portion (When designating for example human body as subject, blood vessel or other shadow) of subject is emphasized by fill of namely, contrast agent subtraction is done, so-called time subtraction which extracts specific portion (blood vessel or other shadow) of subject (subtract) with and, It possesses radiation absorbance which differs with respect to radiation which possesses energy where specific portion of subject differs mutually making use of, irradiating radiation which possesses energy which differs mutually with respect to same subject these with each radiation which possesses energy which differs mutually radiation image of plural obtaining, weighting doing radiation image of these plural suitably, there is a so-called energy subtraction which extracts specific portion of subject with thing (Below-mentioned Formula (1) reference) which calculates difference.

[0007]

$$Sproc = Ka \cdot H - Kb \cdot L + Kc \quad (1)$$

However, as for Sproc as for subtraction image data, Ka, Kb which is acquired by subtraction processing as for weighting coefficient, Kc bias component (Below, collecting Ka, Kb, Kc, parameter of subtraction processing you call), as for H as for the image data, L of so-called high pressure side image data of so-called low pressure side is meant respectively.

[0008]

In addition there is a method of 2 kinds at time of energy subtraction treating, so-called 2 shot energy subtraction processing and with method which is named, as for other one it is a method which is named 1 shot energy subtraction processing in first.

[0009]

[Problems to be Solved by the Invention]

According to 2 shot methods, because difference of energy between each shot can be guaranteed largely, subtraction treating, also the range of image data which is acquired can make contrast of regeneration image which therefore is based on subtraction signal large, high.

But 2 shot methods are acquired with photographing twice and others are image data precision well corresponding every pixel subtraction processing must be done, it was difficult actually to obtain 2 image to which subject with thoracic image where body, especially heart or other movement is extreme, positional relationship coincides precision well, has timely distance.

[0010]

On one hand, 1 shot method, 2 detector it superposes while these 2 detector recording in this case, energy separation plate etc image data which is respectively recorded to both detector by lying between, precision maintaining the image data respectively with photographing one time, positional relationship well between both detector, energy state differs mutually it can make.

But, with 1 shot method guarantees energy difference between both detector largely not to be possible, subtraction treating, because the range of image data which is acquired is small it was difficult to make contrast of subtraction regeneration image which it acquires high.

[0011]

This way in conventional energy subtraction processing, in each case of 1 shot method and 2 shot methods there was a merits and demerits.

[0012]

As for invention of this application considering to above-mentioned situation, being something which you can do, while guaranteeing large energy difference between 2 image data, in regard to utility it guaranteed overlay position precision in fully, acquiring method and device of image information for energy subtraction processing are offered are something which is made object.

[0013]

[Means to Solve the Problems]

acquiring method and device of image information for energy subtraction of this invention irradiating high pressure radiation first with respect to accumulation behavior phosphor sheet for so-called both surfaces light collection, record high pressure image information, way next at once, high pressure image information which is recorded to portion of side (back side) which is opposite, to subject of sheet is not eliminated, sheet, Eliminating only high pressure image information which is recorded to portion of subject side (front side) furthermore irradiating low pressure radiation at once and mainly, stopping the time interval between shot of twice in minimum low pressure image information, by recording to portion of front side of sheet, you control the positional deviation between 2 image data, Furthermore changing high pressure radiation and low pressure radiation inside short time, using properly, it is something which obtains image information for 2 energy subtraction which energy difference fully are guaranteed by recording image information.

[0014]

Namely as for acquiring method of image information for energy subtraction of this invention, with acquiring method of image information for energy subtraction which acquires low pressure image information which corresponds to low pressure radiation where high pressure image information and low energy component which correspond to high pressure radiation where high energy component is emphasized relatively concerning same subject, are emphasized relatively respectively, irradiating aforementioned high pressure radiation to aforementioned subject, To record high pressure image information which corresponds to aforementioned high pressure radiation

which transmitted said subject, to accumulation behavior phosphor sheet for both surfaces light collection which respectively can detect light emitting from both aspects of chart(Chart) aspect and back surface which face to aforementioned subject, to eliminate image information which is recorded to portion of the aforementioned front side said accumulation behavior phosphor sheet, mainly, next, irradiating the aforementioned low pressure radiation to aforementioned subject, low pressure image information which corresponds to aforementioned low pressure radiation which transmitted said subject, is recorded to aforementioned accumulation behavior phosphor sheet (Mainly front side portion of sheet), the aforementioned low pressure image information is acquired, from portion of aforementioned front side of aforementioned accumulation behavior phosphor sheet, aforementioned high pressure image information is acquired is something which is made feature from portion of aforementioned back side.

[0015]

Those if it should have been something where here, accumulation behavior phosphor sheet for the both surfaces light collection reads out image information which is recorded with photographing the one time from front and back surfaces individually and is possible, as the embodiment, on transparent carrier accumulation behavior phosphor layer of one laminate. In order to put between predetermined carrier, those etc which respectively provide accumulation behavior phosphor layer for both surfaces can be applied.

[0016]

In addition, as for above-mentioned carrier in accumulation behavior phosphor sheet of the configuration which laminates accumulation behavior phosphor layer in both surfaces of this carrier, those which are formed by material which can absorb low energy component are desirable.

material which can absorb low energy component is not something which requires material which absorbs low energy component completely and it should have been a material where if ratio which absorbs low energy component in comparison with high energy component is high.

Furthermore, to other than above-mentioned carrier, transmitting the stimulation light or as above-mentioned carrier combines, transmitting elimination light easily, it is desirable between both accumulation behavior phosphor layer to provide intermediate layer which possesses difficult characteristic.

Furthermore and, as for this intermediate layer those which possess characteristic which does not transmit accelerated phosphorescence emitted light are desirable.

Is because fact that accelerated phosphorescence emitted light which is a signal light between both accumulation behavior phosphor layer of sheet blends can be prevented.

[0017]

It detects you say by detecting accelerated phosphorescence emitted light which acquires image information, accumulation behavior phosphor sheet with the laser light or other stimulation light scan to do, light emitting is done concretely because of this from each scan point in photoelectric as electrical signal etc.

[0018]

In addition elimination of image information of front side portion of the above-mentioned sheet, opposing to surface of accumulation behavior phosphor sheet, extending to entire surface, roughly uniform providing elimination light source of flat plate which possesses structure, radiation doing elimination light from this light source, to do it should have tried.

In this case, elimination light source, be able to use EL (electroluminescent) panel and elimination light that light guiding flat plate light guide etc which is done, those where especially that itself, radiation absorbance is small are desirable, those where also thickness of irradiation direction is thin are desirable.

[0019]

Furthermore as above-mentioned radiation, you use single predetermined radiation, as the aforementioned low pressure radiation you are possible as aforementioned high pressure radiation those which were transmitted in high low pressure component absorbing member this predetermined radiation, in comparison with absorbance for low energy component for high energy component to use and, selectively changing high pressure radiation and low pressure radiation from single radiation source, radiation it is possible to do these.

Transmitting in above-mentioned low pressure component absorbing member, there being a form which obtains high pressure radiation, it changes high pressure radiation and low pressure radiation to high speed, by between radiation source and subject taking in and out to high speed in the electrode vicinity of radiation source, low pressure component absorbing member, it is possible.

[0020]

In addition, from lighting of above-mentioned high pressure radiation irradiating low pressure radiation within 100 millisecond it is desirable, it irradiates the low pressure radiation within especially 50 millisecond, it is more desirable.

[0021]

Furthermore description above "It eliminates image information which is recorded to portion of the aforementioned front side mainly" with, possible limit it does not eliminate it means concerning image information which is recorded to portion of back side.

[0022]

Explanation above is similar at time of inventing below.

[0023]

As for acquisition device of image information for energy subtraction of this invention, with the acquisition device of image information for energy subtraction which acquires low pressure image information which corresponds to low pressure radiation where high pressure image information and low energy component which correspond to high pressure radiation where high energy component is emphasized relatively concerning same subject, are emphasized relatively respectively, the selectively changing aforementioned high pressure radiation and aforementioned low pressure radiation, radiation source which it can do and, Irradiating aforementioned subject, respectively it can detect the light emitting, opposing to accumulation behavior phosphor sheet for both surfaces light collection, and, aforementioned surface of said accumulation behavior phosphor sheet it was provided from both aspects of surface and back surface which were allotted to location which receives the radiation which transmitted said subject face to aforementioned subject, extending to entire surface, roughly uniform structure possessing, Radiation doing aforementioned high pressure radiation from elimination light source and aforementioned radiation source of flat plate which elimination light which eliminates image information which is recorded to portion of the aforementioned front side mainly radiation is done recording the aforementioned high pressure image information to aforementioned accumulation behavior phosphor sheet, After that radiation doing elimination light from aforementioned elimination light source, eliminating image information which is recorded to the portion of aforementioned front side mainly next, radiation doing the aforementioned low pressure radiation from aforementioned radiation source and recording the aforementioned low pressure image information to aforementioned accumulation behavior phosphor sheet (Mainly front side portion of sheet), you acquire the aforementioned low pressure image information, from portion of aforementioned front side of aforementioned accumulation behavior phosphor sheet, It is something which had control means which forms control which acquires aforementioned high pressure image information from portion of aforementioned back side makes feature.

[0024]

As above-mentioned radiation source, low pressure component absorbing member which radiation are done taking in and out could provide single radiation unrestrictedly between the radiation electric bulb and said electric bulb and

aforementioned subject which is high in comparison with absorbance for low energy component of the aforementioned radiation for high energy component and, Following to predetermined finger display signal, aforementioned low pressure component absorbing member having drive means which it takes in and out drives between aforementioned electric bulb and aforementioned subject, making use of those of configuration which becomes it is good and, following to predetermined finger display signal, changing high pressure radiation and low pressure radiation, making use of those which consist of single radiation electric bulb of radiation possibility it is good.

[0025]

Furthermore until with above-mentioned control means it irradiates the low pressure radiation from lighting of above-mentioned high pressure radiation, time is within 100 millisecond, it is desirable, within of especially 50 millisecond is more desirable.

[0026]

[Effects of the Invention]

According to acquiring method and device of image information for energy subtraction of the this invention, with respect to accumulation behavior phosphor sheet for so-called both surfaces light collection, irradiating high pressure radiation first, it records high pressure image information, that next at once, high pressure image information which is recorded to back side portion of sheet is not eliminated, it eliminates only the image information which is recorded to front side portion of sheet, Furthermore irradiating low pressure radiation at once, stopping time interval between shot of twice in minimum by recording low pressure image information, to the sheet (Mainly front side portion of sheet), you can control positional deviation between 2 image data, you can acquire image information for 2 energy subtraction which fully it guarantees energy difference furthermore by using properly high pressure radiation and low pressure radiation.

[0027]

Therefore, occurrence of noise which designates positional deviation as the cause can be controlled, energy subtraction image of high image quality where contrast is high with improvement of energy separability can be acquired.

[0028]

[Embodiment of the Invention]

Below, concerning exemplary embodiment of acquisition device of image information for energy subtraction of this invention you explain making use of drawing.

[0029]

Figure 1 is conceptual diagram which shows one embodiment of radiation image photographic equipment as image information acquisition device for energy subtraction of this invention.

[0030]

As for acquisition device of image information for energy subtraction in illustration, with the acquisition device of image information for energy subtraction which acquires low pressure image information S_L which corresponds to low pressure radiation L_L where high pressure image information S_H and low energy component which correspond to high pressure radiation L_H where high energy component is emphasized relatively concerning subject 50 of one, are emphasized relatively respectively, selectively changing high pressure radiation L_H and low pressure radiation L_L, radiation source 10 which it can do and, Irradiating subject 50, opposing to accumulation behavior phosphor sheet 20 for both surfaces light collection which respectively possesses accumulation behavior phosphor layer 21, 22 in both surfaces of carrier 23 which was formed with material which can absorb low energy component of radiation L which

was allotted to location which receives radiation L' which transmitted this subject 50 is irradiated and, accumulation behavior phosphor layer 21 of subject 50 side of accumulation behavior phosphor sheet 20 it was provided, Extending to entire surface, radiation doing high pressure radiation L_H first the EL panel 30 which elimination optical K which eliminates image information which roughly uniform possesses structure, is recorded to accumulation behavior phosphor layer 21 of subject 50 side mainly radiation is done and, from radiation source 10, recording high pressure image information S_H to both accumulation behavior phosphor layer 21, 22 of accumulation behavior phosphor sheet 20, After that radiation doing elimination optical K from the elimination light source 30, eliminating image information (high pressure image information) S_H which is recorded to accumulation behavior phosphor layer 21 of subject 50 side mainly next, radiation doing low pressure radiation L_L from radiation source 10 and recording low pressure image information S_L to accumulation behavior phosphor layer 21 of subject 50 side of the accumulation behavior phosphor sheet 20, you acquire low pressure image information S_L, from accumulation behavior phosphor layer 21 of subject 50 side of the accumulation behavior phosphor sheet 20, It is a configuration which has control means 40 which forms control which acquires high pressure image information S_H from accumulation behavior phosphor layer 22 side which is opposite to the subject 50.

[0031]

low pressure component absorbing member 12 which here as for above-mentioned radiation source 10, furthermore as for details taking in and out could provide unrestrictedly in the radiation electric bulb 11, and this electric bulb 11 and between subject 50 radiation it does the radiation L_0 of one kind is high in comparison with absorbance for low energy component of radiation L_0 for high energy component and, Following to predetermined finger display signal, low pressure component absorbing member 12 it is a configuration which has drive means 13 which it takes in and out drives between electric bulb 11 and the subject 50.

[0032]

tube voltage of radiation electric bulb 11 with 100 kV, uses Cu (copper) filter of the thickness 1 mm as low pressure component absorbing member 12 furthermore regarding this embodiment.

[0033]

Because it is provided in vicinity of radiation electric bulb 11, this filter 12 it is through this Cu filter 12 size of filter 12 because radiation (high pressure radiation) L_H irradiates entirety of sheet 20, comparing to accumulation behavior phosphor sheet 20, quite maybe small, this filter 12, must be moved in order to evacuate from between electric bulb 11 and subject 50, amount of movement is small, It can complete with 10 millisecond extent.

[0034]

In addition, EL panel 30, as for light emission time of elimination optical K in order to eliminate image information which is recorded to accumulation behavior phosphor layer 21 of subject 50 side is 50 millisecond.

[0035]

Furthermore, until with control means 40 it irradiates low pressure radiation L_L from lighting of above-mentioned high pressure radiation L_H, time is controlled within 100 millisecond.

[0036]

Next you explain concerning action of acquisition device of image information for energy subtraction of this embodiment.

[0037]

First, through EL panel 30, through Cu filter 12, destined for subject 50 which is allotted on accumulation behavior phosphor sheet 20, radiation L_0 of tube voltage 100 kV short time radiation is done from radiation electric bulb 11.

radiation L_0 which radiation is done while transmitting Cu filter 12, the low energy component being done attenuation, makes high pressure radiation L_H where high energy component is emphasized relatively, this high pressure radiation L_H irradiates subject 50, the transmitted radiation L_H transmits EL panel 30 and incidence does in accumulation behavior phosphor sheet 20.

[0038]

Here, transmitted radiation L_H which incidence is done incidence doing in accumulation behavior phosphor layer 21 side which first is close to subject 50, compilation records high pressure image information S_H of subject where high energy component is emphasized relatively to this accumulation behavior phosphor layer 21, in accumulation behavior phosphor sheet 20, furthermore radiation L_H which was transmitted while transmitting carrier 23, low energy component being done, furthermore attenuation, from makes high pressure radiation L_H' where high energy component is emphasized, This high pressure radiation L_H', incidence doing in accumulation behavior phosphor layer 22 side which is distant from subject 50, from high pressure image information S_H' of subject where high energy component is emphasized compilation is recorded to this accumulation behavior phosphor layer 22.

[0039]

After this photographing was done, in order at once, concrete after photographing between 10 millisecond extent, with control means 40 with control action for the drive means 13, Cu filter 12, to evacuate from between electric bulb 11 and subject 50, it moves.

[0040]

On one hand, from immediately after photographing between 50 millisecond, with control means 40 EL panel 30 light emitting is done with control action, with this light emitting, compilation is recorded high pressure image information S_H which is eliminated in the accumulation behavior phosphor layer 21 side which is close to subject 50.

However, if this elimination does not have necessity to be a strong elimination of extent which is done in order to reuse accumulation behavior phosphor sheet and high pressure component is eliminated certain extent, it is enough.

[0041]

After this elimination is possible, after at once, concretely, being able to do initial photographing, within 100 millisecond, through EL panel 30, through Cu filter 12, destined for subject 50 which is allotted on the accumulation behavior phosphor sheet 20, radiation L_0 of tube voltage 100 kV short time radiation is done from radiation electric bulb 11.

radiation L_0 which radiation is done, because Cu filter 12 is not transmitted, as in initial photographing low energy component are not times when attenuation it is done, therefore, with respect to initial photographing, the low pressure radiation L_L where low energy component is emphasized relatively (= L_0) with is done, this low pressure radiation L_L irradiates subject 50, transmitted radiation L_L transmits EL panel 30 and incidence does in accumulation behavior phosphor sheet 20.

[0042]

Here, transmitted radiation L_L which incidence is done incidence doing in accumulation behavior phosphor layer 21 side which first is close to subject 50, compilation records low pressure image information S_L of subject where low energy component is emphasized relatively to this accumulation behavior phosphor layer 21, in accumulation behavior phosphor sheet 20, furthermore radiation L_L' which was transmitted while transmitting carrier 23, low energy component being done the attenuation, makes high pressure radiation L_H'' where high energy component is emphasized relatively, This high pressure radiation L_H'', incidence doing in accumulation behavior phosphor layer 22 side which is distant from subject 50, high pressure image information S_H'' of subject where high energy component is emphasized relatively compilation is recorded to this accumulation behavior phosphor layer 22.

[0043]

Here, after high pressure image information S_H which is recorded with photographing first was eliminated, it is decided with that low pressure image information S_L is recorded with photographing second in accumulation behavior phosphor layer 21 side which is close to the subject 50, finally has become state where low pressure image information S_L is recorded.

[0044]

On one hand, it is decided with that high pressure image information S_H' is recorded with photographing second in addition to high pressure image information S_H'' which is recorded with photographing first, in accumulation behavior phosphor layer 22 side which is distant from subject 50, finally has become state where high pressure image information S_H' and the S_H'' are recorded.

[0045]

Therefore, it depended on reading out each image information from both surfaces 21, 22 of these sheet 20 separately, was suited for energy subtraction processing from this sheet 20, with conventional 1 shot method low pressure image information S_L and high pressure image information S_H', S_H'' which in extent which cannot be acquired can designate energy separation as fully can be acquired.

[0046]

Furthermore, irradiating high pressure radiation, to record high pressure image information, that next at once, high pressure image information which is recorded to accumulation behavior phosphor layer side which is opposite to subject of sheet is not eliminated, to eliminate only image information which is recorded to accumulation behavior phosphor layer of subject side of the sheet, furthermore irradiating low pressure radiation at once, low pressure image information, By recording to accumulation behavior phosphor layer of subject side of sheet, with conventional 2 shot method because in extent which cannot be acquired image data for energy subtraction processing can be acquired with short time, positional deviation between both image data can be controlled in fully.

[0047]

This way according to acquisition device of image information for energy subtraction of the this embodiment, with conventional 2 shot method with image information for energy subtraction which controls positional deviation in extent which cannot be acquired, at same time with conventional 1 shot method because image information which in extent which cannot be acquired can designate energy separation as fully can be acquired, This way as for energy subtraction image which regeneration is done, comparing to conventional ones, noise fully is controlled with positional deviation on basis of image information which is acquired, at same time, possess sufficient contrast, the image quality of energy subtraction image can improve.

[0048]

Furthermore low pressure component absorbing member which high pressure radiation L_H and low pressure radiation L_L, taking in and out could provide unrestrictedly in radiation electric bulb and this electric bulb and between subject radiation it does single radiation regarding this embodiment, is high in comparison with absorbance for low energy component of radiation for the high energy component and, Following to predetermined finger display signal, it showed low pressure component absorbing member concerning embodiment are outputted from radiation source which consists of drive means which it takes in and out drives between electric bulb and subject, but acquisition device of image information for energy subtraction of this invention is not something which is limited to this embodiment, Following to for example predetermined finger display signal, changing high pressure radiation and low pressure radiation, making use of radiation source which consists of single radiation electric bulb of radiation possibility it is good it is possible and, as configuration which uses the two of low pressure radiation source which just high pressure radiation source and low pressure radiation which just the high pressure radiation are done radiation is done.

[0049]

In addition, it is possible also, to apply anything except Cu filter as low pressure component absorbing member, in addition, not only a EL panel which description above is done as means which eliminates image information which is recorded to accumulation behavior phosphor layer of subject side, elimination light that light guiding it is possible also to use those which with such as flat plate light guide which is done configuration are done.

[0050]

Furthermore it is not something which is limited to those of configuration if it should have been something which reads out image information which is recorded with photographing one time and, as accumulation behavior phosphor sheet for both surfaces light collection, from front and back surfaces individually and is possible, in embodiment which description above is done was applied, in both surfaces of the carrier 23 respectively accumulation behavior phosphor layer 21, 22 possesses, It can apply also those etc which laminate accumulation behavior phosphor layer of one on for example transparent carrier.

[Brief Explanation of the Drawing(s)]

[Figure 1]

conceptual diagram which shows one embodiment of acquisition device of image information for the energy subtraction of this invention

[Explanation of Symbols in Drawings]

10

radiation source

11

electric bulb

12

Cu filter

13

drive means

20

accumulation behavior phosphor sheet

21

accumulation behavior phosphor layer

22

accumulation behavior phosphor layer

23

carrier

30

EL panel

40

control means

50

subject

LL low pressure radiation

LH high pressure radiation

Drawings

[Figure 1]